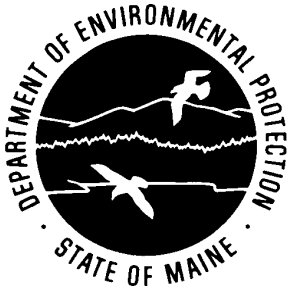
PROCEDURAL GUIDELINES FOR ESTABLISHING ACTION LEVELS AND REMEDIATION GOALS FOR THE REMEDIATION OF OIL CONTAMINATED SOIL AND GROUND WATER IN MAINE



MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION

PROCEDURAL GUIDELINES FOR ESTABLISHING ACTION LEVELS AND REMEDIATION GOALS FOR OIL CONTAMINATED SOIL AND GROUND WATER

MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF REMEDIATION AND WASTE MANAGEMENT

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INTRODUCTION

This guidance document outlines a decision tree approach using site specific geologic and human exposure related criteria to establish remediation goals for oil contaminated soil and groundwater. Bureau of Remediation and Waste Management staff will utilize this revised edition of the "Decision Tree for Establishing Action Levels and Cleanup Goals for Petroleum Contaminated Sites" in decisions regarding the initiation and termination of remediation at underground storage facilities, other subsurface oil discharges, bulk plants, above ground storage facilities, and transportation spill sites contaminated by gasoline, methyl tertiary butyl ether (MTBE), kerosene, #2 heating oil and diesel fuel, or other comparable petroleum hydrocarbons. Decisions regarding remediation objectives for site contaminated by waste oil and heavy oils are not governed by this procedure and will continue to be made on a case-by case basis by Bureau project staff responsible for remediation oversight. This guidance does not apply to any site or a portion of a site where hazardous substances contamination is documented or likely.[1] These guidelines apply to both Bureau funded remediation projects as well as those undertaken by responsible parties or other persons.

The objectives of these guidelines are threefold. The guidelines' first objective is to ensure greater consistency in the level of clean up required of responsible parties statewide, while providing sufficient flexibility to accommodate greatly varying site conditions. Secondly, the guidelines are intended to ensure that decisions regarding remediation are based on the risk of environmental and public health effects. These guidelines emphasize preventing human exposure to oil and petroleum hydrocarbons from contaminated groundwater and to a limited extent, vapors (see the Bureau's separate guidelines for indoor petroleum vapor action levels). Lastly, these procedures are meant to provide guidance to Bureau remediation staff, responsible parties, professional consultants, and others who undertake oil remediation on the performance standards such efforts will be expected to meet by the Department. The final decision on the level of clean-up at a particular site is that of the Department's project remediation staff.

These guidelines, through the decision tree, establish three levels of remediation goals. The first and most stringent is for areas of current or potential future groundwater use for drinking water. Areas in close proximity to public and private drinking water supplies or sand and gravel aquifers would fall under the "stringent standards". For sites where use of groundwater as drinking water is less likely because of its quality and quantity, "intermediate standards" are established to abate on-going sources of groundwater contamination and to minimize the risk of petroleum vapor problems in buildings and utility conduits. Lastly, "baseline standards" are established for all remaining sites, including those located where groundwater has already been contaminated beyond use. Baseline soil contamination standards were divided into two sub-categories: one for industrial sites, and one for non-industrial urban areas. At a minimum, all sites will be cleaned of oil saturated soil and free petroleum products.

[1] Since waste oil is commonly a hazardous waste, clean-up criteria and analyses other than those included in these guidelines often need to be considered. These may include the Department's hazardous waste regulations as well as the Bureau's hazardous substances soil clean-up guidelines.

Flexibility is provided in the guidelines and the decision tree to allow alternate site specific remediation standards for oil contaminated soil and groundwater. Such an alternate standard must adequately protect public health, safety and the environment and be well supported by hydrogeological investigation results or other technical studies approved by the Bureau's remediation staff. Such studies may include risk assessments or contaminant transport studies or modeling. Alternate standards may be either less or more stringent than those indicated by the decision tree methodology and shall be approved by the Bureau. If the terms of this paragraph are satisfied, the Bureau may require more stringent remediation standards as well as allow less stringent standards. In no case involving a leak or other discharge of oil at an underground oil storage tank (UST) facility may we require cleanup standards for soil and ground water at lower concentrations than specified in the "stringent clean up goals" listed in the decision tree. This statutory restriction only applies to the clean up of oil contamination associated with a UST, in the general environment and does not effect our authority to provide for temporary treatment of or the replacement of contaminated drinking water supplies.

The soil clean up goals used by the Department since 1993 were re-evaluated for the purposes of this revision. The Department contracted with the University of Maine's Engineering Department for a study of the relationship of soil contamination concentrations and ground water concentrations using representative native Maine soils.[1] The Department concluded from this work that existing soil clean-up goals were generally appropriate for protecting underlying ground water from being contaminated above existing State of Maine drinking water standards, and the Department's ground water clean up goal where ground water is currently used or needs to be preserved for future use as a drinking water supply.

It was the Department's hope that Maine's drinking water standards for gasoline range organics (GRO), diesel range organics (DRO), and MTBE be re-evaluated by the Maine Bureau of Health in light of current toxicological research results and included in this revision. The drinking water standard for MTBE has been re-examined and changed. After going through rule-making, and the review and approval of the Maine Legislature, the Maine Bureau of Health established a State Maximum Contaminant Level (MCL) of 35 ppb for MTBE. This number is the Department's new clean-up goal for MTBE where remediation of dissolved phase oil contamination in ground water is necessary. To date drinking water standards for GRO and DRO have not yet been revised. When they are, they will be incorporated in this document.

[1] Venkatesh Uddameri, "Methodologies to Derive Soil Cleanup Levels at Contaminated Sites" (Ph.D. Thesis, Civil and Environmental Engineering, University of Maine, 1998)

Another change in this guidance document is the incorporation of the Department's existing interim ground water action levels for the initiation and termination of dissolved phase remediation. Again this applies only to the most sensitive sites. Generally, these contaminant concentrations are ½ of the drinking water standard, except for MTBE and DRO. For MTBE the action level was set at 25 ppb by the Commissioner at the time of Legislative discussion regarding MTBE. The action level and remediation goal for DRO are set at the same concentration, 50 ppb (the practical quantification limit of the DRO lab method). The action levels and guidance as to their use, are incorporated from the BRWM's October 21, 1997 "Interim Standard Operating Procedure: Oil Contaminated Ground Water Remediation Action Levels".

A summary of the decision tree is presented as a flowchart (Appendix A) at the end of these Guidelines for use as a quick reference. Also provided at the end of this document is a table summarizing the Guidelines' clean-up goals (Appendix B), and action levels (Appendix C).

This document replaces the February 1, 1995, and October, 1998 editions of these remediation guidelines.

DECISION TREE FOR ESTABLISHING ACTION LEVELS AND CLEANUP GOALS

FOR OIL-CONTAMINATED SITES

The decision tree which follows was developed for use by Bureau of Remediation and Waste Management (BRWM) personnel to determine when to initiate and the level of clean-up required for petroleum hydrocarbon releases. The action levels and clean-up goals are designed to protect groundwater aquifers that are presently used or may be used in the future to supply drinking water for human use. The goals are also intended to minimize public health and safety problems caused by petroleum vapors. The Department investigator always has the option of setting more strict clean-up goals if appropriate for the specific characteristics of a site. Less strict standards should not be used unless an appropriate hydrogeologic review and/or investigation has been completed, supporting such an action.

The decision tree is intended to standardize the decision-making process used both in response field work and in long-term site remediation. It can be used during the initial field response investigation as well as after a detailed hydrogeological study (if necessary). However, use of this decision tree in the early stages of investigation may not negate the need for additional site characterization or monitoring.

Some of the information required calls for the investigator's judgment of conditions which cannot be directly observed, such as water table location or soil material at the site. The investigator will sometimes be able to obtain this information from people who are familiar with the area (water table information from homeowners with dug wells; location of private wells from area residents). Other information may come from observation of the tank excavation itself; from presence/absence of hydrocarbon odors in basements; from topographic, sand/gravel aquifer or geologic maps; or from field instruments such as PIDs, water level measuring devices; or the measurement of distances.

There will be instances where a needed piece of information cannot be readily obtained. In these cases the investigator should assume the most reasonable "worst case" and note this as a point to be followed up by a geologist at a later time if necessary. At some sites, the published information may conflict with observed conditions (a site overlying sand and gravel which is not mapped as a sand/gravel aquifer). Again the initial investigator should assume the worst case (that the site **is** an aquifer which has not been mapped) and note the conflict.

If extensive fill is present at a site it should be classified as the natural material it resembles most closely until natural surficial materials underlying and around the filled area can be investigated.

INSTRUCTIONS

Proceed thru the decision tree criteria until you have reached a clean-up goal then stop. If there is something you don't understand about a question or criteria please refer to the corresponding number on the attached explanation sheet. Once you have reached 12, 13, or 14A or 14B you have chosen a clean-up action level and goal. Example: Your answer to question 1 is no; you then go to question 2 and your answer is yes; you then go to question 2A and your answer is no; you then go to 12 which gives you the clean-up action levels for the dissolved phase goal. You then use the clean-up goal to determine how much soil to remove, or otherwise remediate.

HYDROCARBON SPILL DECISION TREE

Investigator:_____ Site Name, Address:_____

Spill Number:_____ Town:_____

		If "Yes" Go To	If "No" Go To
1.	Is a public water supply well or intake located within 2000 feet of the leak or discharge site, or is the site located within a wellhead protection or recharge zone of a public water supply well?	12	2
2.	Is the leak or discharge site located in or over a sand and gravel deposit?	2A	3
2A.	Is the entire area, within a 2000 foot radius of the leak or discharge site, a non-attainment zone?	2B	12
2B.	Is there potential for vapor problems within buildings or for a confined space fire or explosion hazard?	13	11A
3.	Was the release directly into bedrock or is the bedrock groundwater system contaminated?	9	4
4.	Was the release directly into a glacial till deposit?	9	5
5.	Was the release into a silt or clay deposit.	6	N/A
6.	Is there at least 10 feet of silt and/or clay between the contaminated zone and underlying more permeable surficial deposits (such as glacial till or sand and gravel) or bedrock	7	9
7.	Are the area's gradients approximately horizontal (topographic gradient flat or groundwater gradient <1%)?	8	9
		If	**If**

		"Yes" Go To	"No" Go To
8.	Does the seasonal low of the water table fall below the top of the underlying aquifer (sand and gravel deposit or bedrock)? If unknown, the answer is yes.	9	10
9.	Is the area within 2000 feet downgradient or 1000 feet upgradient served by a public water supply? (If there are <u>any</u> private wells within this area, answer "No")	10	12
10	Is there potential for vapor problems within buildings or for a confined space explosion hazard?	13	11
11.	Is the entire area, within a 2000 foot radius of the leak or discharge site, a non-attainment zone?	11A	13
11A	Is the site now or in the past been in a predominantly industrial land use?	14A	14B

CLEAN-UP GUIDELINES

12. Stringent (ST) Clean-Up Action Levels and Goals

<u>Groundwater Clean-up Action Levels:</u>

Dissolved phase ground water contamination action levels are 25 ppb for GRO; 50 ppb DRO; 2ppb for benzene; and 25 ppb for MTBE.

<u>Cleanup Goals:</u>

Remove all free product.

Remove or remediate contaminated soil containing greater than 10 mg/kg diesel range organics, or 5 mg/kg gasoline range organics as determined by a DEP-approved laboratory method.

Remediate groundwater containing greater than 50 ug/l gasoline or diesel range organics, 35 ug/l MTBE or 5 ug/l benzene measured by DEP approved laboratory methods.

13. Intermediate (IN) Clean-Up Goals

Remove all free product.

Remove or remediate contaminated soil containing greater than 10 mg/kg diesel range organics, or 5 mg/kg gasoline range organics as determined by a DEP-approved laboratory method.

14. Baseline Clean-up Goals

14A. Baseline-1 (BL1):

Remove all free product.

Remove or remediate soil "saturated" with gasoline, kerosene, or fuel oil.[1]

14B. Baseline-2 (BL2):

Remove all free product.

Remove or remediate contaminated soil to: 500 to 1,000 ppm gasoline range organics and 200 to 400 ppm diesel range organics, each as measured by the DEP field headspace analysis or its Department approved equivalent field method.

Note: Where there is significant uncertainty regarding the identity of the product, the lower of the gasoline or diesel range organics' standards shall apply; and, at sites in the stringent category, groundwater shall be analyzed for MTBE and benzene.

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[1] "Saturated" is defined in paragraph 14 in the following Explanation section of this document.

EXPLANATION OF CRITERIA
AND
CLEAN-UP ACTION LEVELS AND GOALS

The following explanatory notes are numbered to correspond to the numbering of the decision tree's questions and criteria.

1. The local water supply utility or agency should be contacted to determine the area served, well locations, and the locations of wellhead protection and recharge zones.

2. This will be pretty obvious if you excavate into it. If you aren't able to or haven't done this yet you can refer to the surficial geology maps published by the Maine Geologic Survey for many quadrangles in the state. Units on these maps which are dominantly sand and/or gravel include beach, aeolian (wind deposited), coarse grained glaciomarine, glacial outwash, and esker deposits. Some moraine and glacial till deposits may also be composed predominantly of sand and gravel. The Presumpscot Formation contains some sandy deposits. You should answer yes if the area is mapped as a sand and gravel aquifer on the significant aquifer maps published by the Maine Geologic Survey unless detailed investigation proves that the answer is no.

   If wells are located on or close to the site, the well drillers may be able to give you descriptions and thickness' of surficial materials.

   2A. See explanation 11.

3. Answer yes if a tank (or contaminated soil) lies directly on bedrock or if a surface spill is partially or completely on the bedrock surface. Distinguishing bedrock (called "ledge" by some people in Maine) from large boulders can be a problem. If there are several rock surfaces exposed in an area and they are composed of the same rock type (s) or have structures that trend in the same direction they are likely to be exposures of the true bedrock surface.

4. Till is material deposited directly by a glacier at its base as it moves over the earth's surface or as the glacier melts. Tills generally contain a wide range of grain sizes from large boulders to clay sized material more or less randomly intermixed. Such tills are very cohesive and are often referred to as "hardpan" in Maine. Surficial geology maps show areas where tills are exposed at the earth's surface. In many areas of Maine tills underlie Presumpscot Formation silt/clay deposits or glacial outwash sand and gravel's.

   Unfortunately for our purposes some tills contain very little silt or clay sized material and are not very cohesive. Such deposits look more like sand and gravel deposits and contaminants may be transported through such deposits almost as readily. Such tills should be treated as sand and gravel deposits (potential aquifers) when setting

clean-up levels. A good indication that a till is composed mainly of sand and gravel is the presence of a gravel pit in an area the Maine Geological Survey has mapped as till.

5. Again silt or clay will usually be obvious when you see it. Some of these deposits may have a few sand grains or scattered pebbles mixed in but if you collect a moist, hand sized sample from any part of the deposit it will be very cohesive when pressed together. The best published sources showing the distribution of this material at the ground surface are surficial geology maps. Map units representing deposits composed of these materials are lacustrine (lake), alluvial (stream), swamp, and fine grained glaciomarine deposits. The Presumpscot Formation, a widespread marine unit which was deposited up to about 60 miles inland from the present coastline following the last glacial period, is composed primarily of silt and clay sized particles. If silt or clay deposits contain numerous, possibly interconnected layers or lenses of sand and/or gravel, then the material should be treated as a sand or gravel for the purpose of setting clean-up goals.

6. There should be at least 10 feet of homogeneous silt and clay separating the contaminated zone from the top of underlying more permeable deposits such as till, sand and gravel, or bedrock. The depth from the contaminated zone to the top of these materials may be determined from boring logs or by measuring the depth of overburden in the excavation. If you don't have hard data on the depth you should assume that it is less than 10 feet. The thickness of overburden can vary greatly over short distances and there can be substantial variability even in areas where fairly thick surficial deposits are mapped.

7. If you have water level elevations from 3 nearby water table wells you can use the data to calculate the water table gradient. The wells should be screened or otherwise open (uncased) across the water table surface. Both dug and drilled wells may be used for this purpose although some dug wells may intersect a perched water table rather than the true water table. Most drilled water supply wells will not give an accurate representation of the water table elevation because they are not screened across the water table or they extend too far below the water table. Data from such wells must be used very carefully.

   If you do not have water table data you will have to estimate the gradient based on the topographic gradient. This is possible because in many cases the water table gradient follows the topographic gradient although the water table gradient is generally less steep. To use this method compare the difference in elevation between the leak site and the nearest substantial water body such a lake or year round stream. This is necessary because the area of the leak site may appear flat but the water table may slope toward a lake or stream which cannot be seen directly from the leak site. It is possible that geologic conditions at the site may greatly reduce the accuracy of this estimation method. For this reason it should be used conservatively. The investigator should also be aware that pumping of wells may draw down the water around the well

and/or in the intersected fracture systems. This can change or even reverse natural gradients.

8. The water table is the top of the saturated zone. Maine state law defines a "significant groundwater aquifer" as "a porous formation of ice contact and glacial outwash sand and gravel or fractured bedrock that contains significant recoverable quantities of water which is likely to provide drinking water supplies." Obviously, the aquifers of most concern to us are sand and gravel deposits and bedrock. Approximate locations of many sand and gravel aquifers have been mapped by the Maine Geological Survey and published on Significant Aquifer or Sand And Gravel Aquifer maps. Bedrock must be protected because (1)it is typically the major source of drinking water in rural areas, (2) it can be extremely hard to remediate once contaminated, and (3) there is potential for high yield wells(for public or commercial purposes) in bedrock even though there has been very little exploration for them and few have been developed in Maine.

   If the water table is always above the top of the sand and gravel deposit or bedrock surface then floating contaminants such as hydrocarbons are less likely to contaminate the aquifer. This is particularly true if the water table surface is horizontal. In Maine the water table does not usually fluctuate more than 10 feet throughout the year so if you can determine that the water table is more than 10 feet above top of an aquifer when you are at a site you can probably conclude that it is always above the top of the aquifer. (In general the water table fluctuation at most sites will be less than 5 feet).

9. This may be determined by questioning people or businesses within the area or by contacting the municipal government or other public water supply organization. Be aware that there are some sites where businesses or individuals may have their own water supply systems even though public water is available. This is a common error in the use of these guidelines.

10. The potential for vapor problems exists wherever there is a source for vapor generation (free product, contaminated soil, contaminated water, etc.); a pathway to transport the vapors (porous soils, utility line backfill, etc.); and, a trap to collect vapors (such as a basement, manhole, etc.). Vapor problems can occur indirectly when heavily contaminated water is pumped into a building or directly when vapors enter through cracks or other openings in foundations. Many developed areas will have potential for vapor problems. Structures with low probability of vapor problems include buildings on slabs, especially if they have continuously operated ventilation systems.

11. A non-attainment zone, for the purpose of these guidelines only, is an area from which groundwater will not be withdrawn for human use because of environmental and/or institutional factors. Non-attainment zones are defined by the criteria listed in 11A, 11B, or 11C below.

    11A. The zone is in an urban or other heavily developed area made up predominantly of dense commercial or industrial land uses, OR dense

residential (1/2 acre lots or less) development with subsurface waste water disposal, and where no water quality testing data is available. In addition the area must meet all the following criteria as well:

(1) The area within 2000 feet downgradient and 1000 feet upgradient of the leak or spill must be served by public water; **and**,

(2) No private drinking water supply wells are located within 1000 feet of the discharge; **and**

(3) The site of the leak or spill must not be within 2000 feet of a public water supply well or within the wellhead protection zone of a public water supply well.

OR

11B. Local or state laws or regulations which prohibit human consumption of the area's ground water because of poor natural water quality, prior documented pollution or high potential for pollution due to past or present land uses. The existence and applicability of such local ordinances may be confirmed by the town planning board, code enforcement officer, town manager or selectmen. (NOTE: No State ground water classification or other laws currently exist which rule out areas of the State for drinking water).

OR

11C. Previous hydrogeological studies or water quality testing data demonstrate to the Department's satisfaction that, due to the presence of contaminants other than oil or of other pre-existing contaminant sources, groundwater in the area is unfit for human consumption due to violation of the State's maximum exposure guidelines (primary standards) or Federal maximum contaminant levels for one or more contaminants.

12. The purpose of this goal is to prevent or remediate contamination of groundwater and prevent or correct vapor and confined space explosion hazards. Where this goal and it’s associated action levels are applied, it is assumed that groundwater is needed or may later be used for human consumption. Final groundwater and soil clean-up levels may have to be determined based on knowledge of technical limitations of remediation techniques and site specific environmental factors since each media may contaminate (and re-contaminate) the other.

13. The purpose of this goal is to prevent further groundwater contamination and allow for natural groundwater clean-up by physical processes, biotic and abiotic degradation, or by all three. An additional purpose is to eliminate confined space explosion hazards and decrease the potential for human exposure to hydrocarbon vapors. Where this standard is applied it is assumed that the groundwater will not be used for human

consumption in the immediate future. In this classification the clean-up goal for soil may not be immediately attainable if groundwater contamination is high. The reason for this is that heavily contaminated groundwater may re-contaminate clean soil as new equilibrium concentrations in the two media are established.

14. The purpose of this goal is to remove free product that may be mobile in the environment. If sufficient product is present in soils at a site it could potentially move in response to gradients and contaminate a larger area. The presence of free product also creates severe vapor explosion and exposure hazards. After removal of free product, residual contamination left in the soil may be a source for dissolved contamination in ground water and hydrocarbon vapors. Where this goal is applied it is assumed that the groundwater will not be used for human consumption and will not discharge to the surface until significant natural attenuation of the contamination has occurred. It is also assumed that no vapor conduits or traps which could cause health or safety hazards are present in the contaminated area.

The term "saturated" is used to describe soils which contain mobile product. It does not necessarily mean that the soils are truly saturated. "Saturation" may be identified by placing a handful of soil in a clear container and submerging it in water. The soil should then be stirred to break up any clumps. If product droplets or a product layer forms on the water, the soil should be considered "saturated". The presence of a sheen does <u>not</u> indicate "saturation". It may be easier to see the product if the water is decanted into a narrow container such as a VOA vial (40 ml.). It may also be necessary to let silty or clayey materials settle for a few minutes in order to determine if product is present.

Baseline sites have been subdivided into two categories to reflect current and historical land use, Baseline-1 (BL1) for industrial areas and Baseline-2 (BL2) for other land uses. The BL1 category is for large, current or former known industrial sites, where the contamination and its affects are in all likelihood restricted to the industrial site itself or to other surrounding industrial lands. Common examples would include railroad yards, oil terminals, paper mills, other large manufacturing facilities and former coal gasification sites. BL2 sites include all other non-industrial properties, such as downtown urban areas, commercial strips, and other densely developed residential and commercial areas where the ground water is not currently used nor is it likely to be used in the future. The primary reason for the more stringent BL2 soil standards is the unacceptability of leaving gross soil contamination in residential and commercial areas, ultimately resulting in vapor or other problems in the future, requiring the Department and the responsible party(ies) to return to the site to undertake costly further remediation which could have been easily avoided.

To accommodate the variety of sites that fall into the BL2 category and the Guidelines' reliance on field analytical methods, a range of acceptable soil remediation standards is provided for greater flexibility with which to better match the remediation standard to the conditions that exist at that specific site. Bureau remediation program staff may choose to select an individual numeric standard, or to establish an objective for a

given site to simply attain levels of residual contamination anywhere within the BL2 range.

RECOMMENDED USE OF ACTION LEVELS

The purpose of the action levels is two-fold. The first is to guide when, and when not to require or fund the monitoring, treatment and remediation of dissolved phase contaminated groundwater, including contaminated drinking water supplies. The second purpose, or objective, is to provide guidance when contamination sites currently undergoing investigation, monitoring or remediation are to be closed and remediation expenditures to cease. Some level of investigation is necessary for any site where oil contamination is detected in drinking water, even if it appears to be below all action levels, in order to use these Guidelines. Some level of investigation is necessary for any site where oil contamination is detected in drinking water, even if appears to be below all action levels, in order to use these Guidelines.

This guidance applies to all Bureau of Remediation & Waste Management staff and their decisions concerning when, and to what extent, to require responsible parties or to fund from the Maine Groundwater Oil Cleanup Fund or other Department funding sources the investigation or remediation of oil contaminated groundwater. This guidance covers the investigation, monitoring and remediation of oil contaminated private and public drinking water supply wells, as well as ambient groundwater.

For the purposes of this guidance document, an action level is defined as the prevailing dissolved phase concentration of an oil analyte in groundwater as determined by a Department approved groundwater sampling plan and by a laboratory method approved in accordance with Appendix S of Chapter 691 of the Department's regulations that equals or exceeds one half of the U.S. Environmental Protection Agency maximum contaminant level (MCL); or where no MCL has been established, the State MCL or maximum exposure guideline (MEG), established by the Maine Bureau of Health in the Department of Human Services (DHS). Not withstanding the above, the action level for benzene is a groundwater concentration equal to or exceeding 2.0 ppb. For diesel range organics the action level is 50 ppb[1] The Department action level for MTBE is 25 ppb or greater. As drinking water health standards change, the respective action level will change accordingly for use in future Department decisions.
The term "contamination" has the same meaning as in Chapter 691 Section 3 subsection g. Under that definition any reportable laboratory result above laboratory detection levels and significantly higher than background levels from other sources, constitutes contamination of groundwater.

Investigation and Remediation of Ambient Groundwater:

This guidance should be used in conjunction with Chapter 691. In accordance with Chapter 691, the decision to require an initial hydrogeological investigation is at the Department's

[1] The Department has found over time that the current Maine Modified Dro Method for Determining Diesel Range Organics, Method 4.1.25, does not currently produce reliable results below 50 ppb, making it not feasible to have an action level below the current State drinking water standard.

option. That decision continues to rest with the project geologist as is current practice. However, this document affects whether to investigate further or to pursue dissolved phase groundwater remediation based on the findings of an initial hydrogeological investigation.

The Department has found over time that the Maine Modified DRO Method for Determining Diesel Range Organics, Method 4.1.25, does not currently produce accurate results below 50 ppb, making it not feasible to have an action level below the current State drinking water standard.

Investigation or remediation of groundwater contamination is required when prevailing concentrations of dissolved phase oil contamination over a 12 month period should equal or exceed the action level for gasoline range organics (GRO), diesel range organics (DRO), benzene, MTBE or other oil analytes, except where drinking water supplies are affected or threatened. Conversely when prevailing concentrations are below applicable action levels for 12 consecutive months groundwater remediation should be terminated and the project closed after additional 12 months of confirmation monitoring. If concentrations increase above the action levels, further investigation, remediation or monitoring should be considered in accordance with this paragraph.

Remediation of Contaminated Private Wells:

How are the action levels to be applied to the decision to provide interim point of entry treatment and the monitoring of contaminated private residential drinking water supplies? For newly reported oil discharge sites all private water supplies found by Bureau staff to be contaminated or at imminent risk of contamination must be sampled for contamination by laboratory analysis in accordance with current Bureau procedures. Wells verified by two or more sample analyses to be contaminated above an action level are to be provided with point of entry (POE) treatment and placed in the Bureau's quarterly monitoring program. Where contamination is documented but at concentrations below the action levels, the decision whether to provide temporary POE treatment must be based on the site specific judgment of the project staff on whether contamination concentrations are expected to increase, remain stable or decrease. If contamination levels are expected to increase (e.g. low levels of MTBE at the leading edge of a suspected gasoline plume; or concentrations of #2 fuel oil below the laboratory's reporting limit (50 ppb), but near a recent heating oil tank failure) or cannot be predicted, temporary point of entry treatment should be provided along with quarterly monitoring until such time as a trend in the influent concentration can be determined. If quarterly monitoring reveals the concentration remains below the action levels, for 4 sequential quarters, POE treatment should be discontinued. Quarterly monitoring should be continued for at least an additional 12 months after POE treatment is terminated to verify the concentrations are likely to remain stable and below the action levels.

The decision to place an "at risk" well on quarterly monitoring also should be governed by site specific circumstances. If contamination is likely given the site's geology and the circumstances of the discharge, the well should be placed on quarterly monitoring until such time as four quarters has passed without a reportable indication of contamination. If the well becomes contaminated, it is managed in a manner consistent with the preceding paragraph, guided by the concentration levels and trends. Quarterly monitoring may be continued as determined appropriate by the project geologist based on site specific geology or other

unique circumstances, or if additional data is needed as part of the overall site monitoring plan.

Concentration levels should also guide decisions concerning the replacement of contaminated private drinking water supplies or provision of long term treatment for these water supplies. Such long term remediation actions should be provided or required where prevailing contaminant concentrations are at or above the action levels, and are likely to remain so.

Remediation of Contaminated Public Drinking Water Supplies:

The action levels also are to be applied in making decisions in the monitoring, treatment and remediation of the contaminated public drinking water supplies. Transient non-community public water supplies (e.g. motels, restaurants, churches, town meeting halls) should be handled in the same manner as private residential drinking water supply wells as described above. Decisions to treat and monitor non-transient, non-community public water supplies (e.g. schools, larger places of employment, food processing facilities, etc) should be governed by the same criteria, however, the Bureau of Health should be notified and monitoring and treatment shall be in accordance with the Department's Memorandum of Agreement with that agency (Appendix D). Decisions on whether to monitor, treat or remediate community public drinking water supplies contaminated or at imminent risk of contamination by oil should be made jointly with staff in the Maine Bureau of Health's Drinking Water Program. Bureau of Health staff shall be contacted when any public drinking water supply (privately or publicly owned) is found to be contaminated or at imminent risk of contamination, including contamination at low levels.

Investigation of Potential Contamination Sources:

When a contaminated private or public water supply well has been documented, the source of the contamination should be investigated (if not known) and preventive measures taken if feasible, as is required under Department regulation and statute and current practice regardless of the concentration of oil (even when below all action levels). The objective of this paragraph is to prevent further contamination of drinking water supply wells by removing the source.

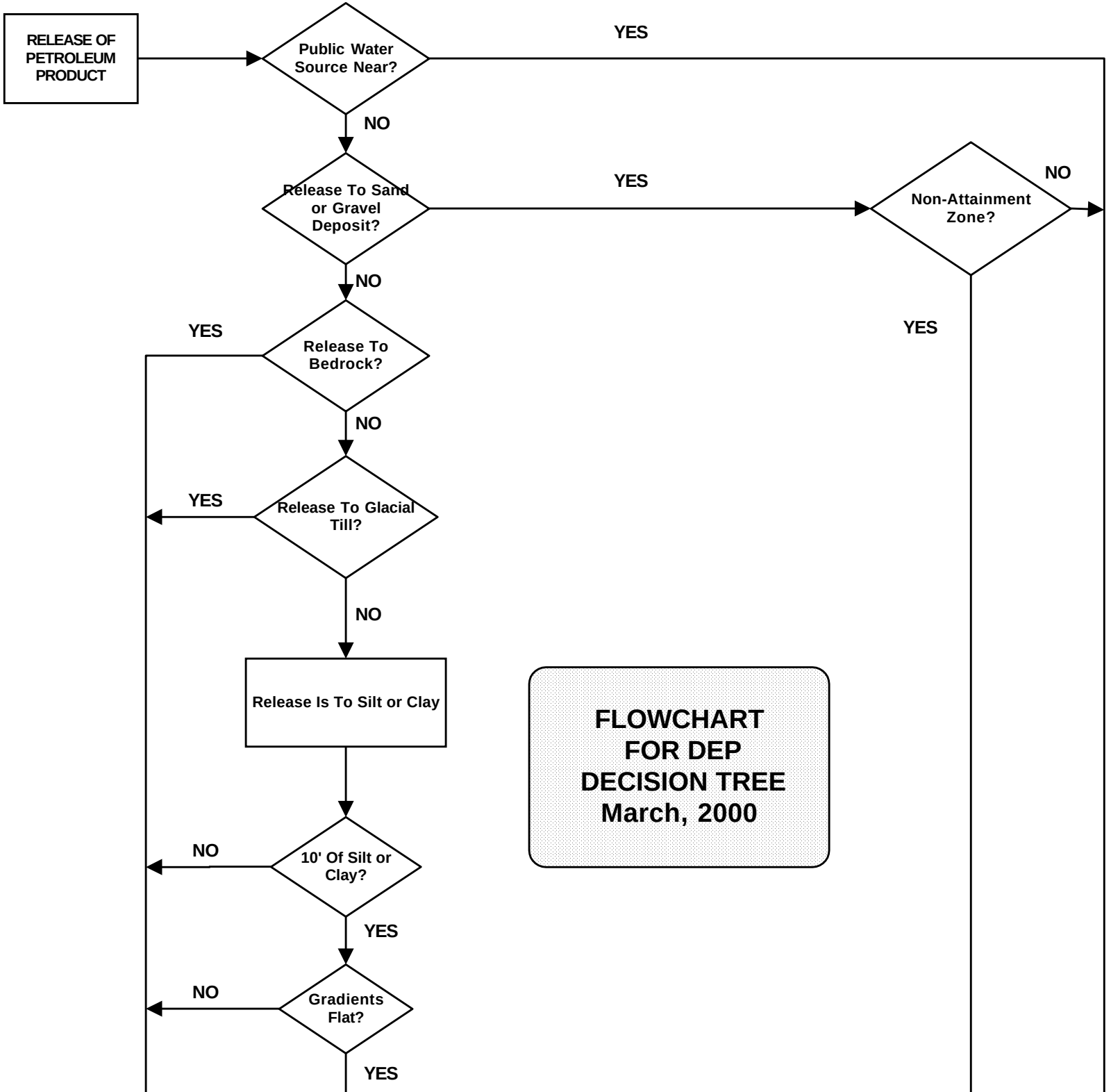
Varying from Action Levels:

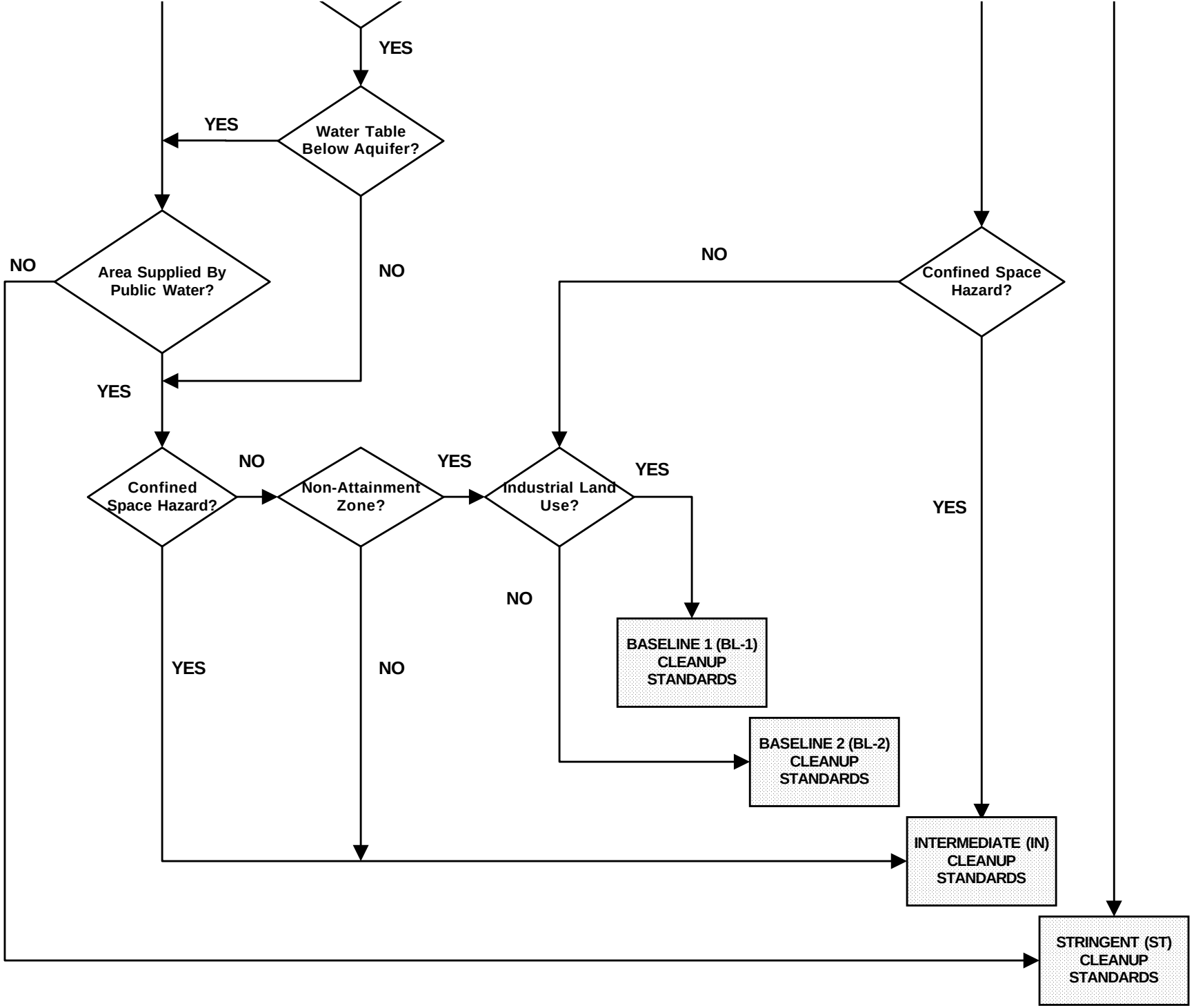
If unusually sensitive exposed individuals or other unusual health risks may be present, Department staff deciding clean up levels for any given site may vary from these action levels with appropriate prior approval. Variances from the use of the action levels may be considered for long-term remediation sites with unusually sensitive exposed individuals, or with unusual site geology or other circumstances where it is deemed: (1) necessary to adequately protect public health; and (2) technically feasible and cost effective in the professional judgment of the Department project staff. Under such circumstances the action levels and the reasons for the variance must be documented in the Department's project file, including how such decisions meet the criteria listed above. In any case, where a party claims they are hypersensitive or have other health related reasons for requiring lower exposure levels than outlined in this guidance, written documentation to that effect from a properly licensed doctor is needed to justify such a variance.

Dtree2000

APPENDIX A

FLOWCHART OF DEP OIL REMEDIATION DECISION – TREE


RELEASE OF PETROLEUM PRODUCT
Public Water Source Near?
YES
NO
Release To Sand or Gravel Deposit?
YES
Non-Attainment Zone?
NO
YES
NO
Release To Bedrock?
YES
NO
Release To Glacial Till?
YES
NO
Release Is To Silt or Clay
10' Of Silt or Clay?
NO
YES
Gradients Flat?
NO
YES
FLOWCHART FOR DEP DECISION TREE March, 2000


YES
Water Table Below Aquifer?
YES
NO
Area Supplied By Public Water?
NO
YES
Confined Space Hazard?
NO
Non-Attainment Zone?
YES
Industrial Land Use?
YES
NO
Confined Space Hazard?
YES
NO
YES
NO
BASELINE 1 (BL-1) CLEANUP STANDARDS
BASELINE 2 (BL-2) CLEANUP STANDARDS
INTERMEDIATE (IN) CLEANUP STANDARDS
STRINGENT (ST) CLEANUP STANDARDS

APPENDIX B

SUMMARY TABLE OF REMEDIATION GOALS FOR OIL CONTAMINATED SOIL AND GROUND WATER

SUMMARY OF REMEDIATION GOALS
FOR OIL CONTAMINATED SOIL & GROUND WATER

CLEAN UP GOAL	Free Product Removal	CONTAMINATED SOIL					DISSOLVED PHASE PRODUCT				
		Saturated Soil	Gasolines	Test Mthd	Fuel Oils/Kero. (1)	Test Mthd	Gasolines	MTBE	Benzene	Fuel Oil(1)	Test Mthd
ST	yes	yes	5 mg/kg	Lab (2)	10 mg/kg	Lab (2)	50 ppb	35 ppb	5 ppb	50 ppb	Lab (4)
IN	yes	yes	5 mg/kg	Lab (2)	10 mg/kg	Lab (2)	None	None	None	None	NA
BL2	yes	yes	500-1000 ppm (3)	Field Hdspace	200-400 ppm (3)	Field Hdspace	None	None	None	None	NA
BL1	yes	yes	None	NA	None	NA	None	None	None	None	NA

Footnotes:

(1) Does not include heavy oils that are heated while being stored. Heavy oil clean-up standards are decided on a case by case basis. Includes #2 heating oil, diesel fuel, kerosene and heating oils other than heavy oils as well as a waste oil that is not a hazardous waste.

(2) Laboratory methods for gasoline in soil and fuel oil in soil are Maine HETL Modified Method for Determining Gasoline Range Organics, 4.2.17, and HETL Method for Determining Diesel Range Organics, 4.1.25.

(3) If laboratory analysis is used, the cleanup standard is 50-100 mg/kg for each gasolines and fuel oils, as determined by methods in Note 2.

(4) Laboratory methods for testing water are Maine HETL Modified Method for Determining Gasoline Range Organics, 4.2.17; . U.S. EPA Method 8260 for benzene and MTBE, and HETL Method for Determining Diesel Range Organcis, 4.1.25, for fuel oils, diesel fuel and waste

APPENDIX C

SUMMARY TABLE OF OIL REMEDIATION ACTION LEVELS

APPENDIX C

SUMMARY OF DRINKING WATER STANDARDS & ACTION LEVELS FOR THE MOST COMMON OIL CONTAMINANTS (IN PPB)

Contaminant	GRO	Benzene	MTBE	DRO
MCL[1]	NA	5	35	NA
MEG	50	5	NA	50
Action Level	25	2.0	25	*50*

[1] Includes Federal EPA and State of Maine adopted MCLs. The MCL for benzene is a Federal MCL, while the MCL for MTBE was adopted by rulemaking by the Maine Bureau of Health and approved by the Maine Legislature.

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APPENDIX D
MDEP AND MDHS BUREAU OF HEALTH MEMORANDUM OF UNDERTANDING REGARDING TREATMENT FOR OIL CONTAMINATED NON-COMMUNITY PUBLIC WATER SYSTEMS

MEMORANDUM OF UNDERSTANDING

Between the Departments of

ENVIRONMENTAL PROTECTION,
BUREAU OF REMEDIATION & WASTE MANAGEMENT

And

HUMAN SERVICES, BUREAU OF HEALTH
DRINKING WATER PROGRAM

This Memorandum provides the framework for the working relationship between the Maine Department of Environmental Protection, Bureau of Remediation & Waste Management (BRWM), and the Department of Human Services, Bureau of Health, Division of Health Engineering, Drinking Water Program (DWP), with regard to installation, maintenance, and monitoring of point-of-entry (POE) treatment equipment installed by BRWM on non-community public water supplies regulated by DWP. It also provides for the sharing of water quality data to expedite the investigation and remediation of threats to public drinking water supplies.

BRWM, to protect public health and the environment from contamination by petroleum and hazardous substances, often installs POE treatment equipment on water supplies, some of which are "public water systems" under Chapter 231 of DWP rules. When a water supply is contaminated, it usually is best to restore potability quickly to minimize the exposure and risk to the health of its users. BRWM is required by statute to use the most cost-effective means of protecting public health and the environment from adverse effects of hazardous materials.

DWP ensures that all public water systems are designed and operated in accordance with Maine Rules Relating To Drinking Water (Chapter 231) and the federal Safe Drinking Water Act (SDWA). SDWA regulations (40 CFR Part 141) require that owners of all public water systems receive approval from DWP prior to making any changes in treatment processes. In addition, new treatment equipment may be subject to additional monitoring as necessary to safeguard the health of consumers.

Non-community, non-transient public water systems are defined as systems that serve at least 25 of the same persons for six months or more per year, such as schools and factories or office buildings having 25 or more employees. Non-community, transient public water systems serve at least 25 persons, but not necessarily the same persons, for at least 60 days of the year, and include restaurants, motels, and campgrounds.

In order that both agencies can fulfill their respective responsibilities expeditiously and share information obtained on treatment equipment performance, the agencies agree as follows:

BRWM agrees to:

1. Notify DWP when any public water supply has been confirmed by BRWM to be contaminated above BRWM-established action levels or is considered at imminent risk of becoming contaminated. Action levels are set at one-half the drinking water Maximum Contaminant Level (MCL), when one exists, or at one-half the Maximum Exposure Guideline (MEG) when no MCL has been established, except for MTBE, where the BRWM action level is 25 ppb.

2. Notify DWP beforeBRWM installs point-of-entry (POE) treatment equipment on any public water system or makes changes in treatment equipment or techniques previously approved by DWP, and submit schematic diagrams of the treatment train promptly after its installation . Treatment technologies used will be approved by USEPA as best available technology (BAT) or other means available for achieving compliance with the applicable MEG or MCL for contaminants listed in 40 CFR 141.61, and in accordance with good engineering practice for contaminants not listed. Equipment will be sized, designed, and installed such that water available to the public for consumption meets all MCLs, where these have been established, and MEGs when no MCL is in effect. The need for pretreatment equipment to ensure effective, reliable operation of treatment equipment will be evaluated based on the water chemistry of individual sites. BRWM will eliminate bypass plumbing in all existing POE equipment in public water systems, and will ensure that its contractors do not install bypasses in the future.

3. Monitor effectiveness of BRWM-installed treatment equipment as needed. Where a water source is contaminated with an organic compound or a petroleum product, BRWM will analyze the finished water at least quarterly using EPA Method 524.2 for that compound or constituents of the petroleum product for which there is a drinking water standard. BRWM will notify DWP promptly when post-treatment water quality does not meet drinking water standards.

4. Provide DWP with a list of regional contacts and FAX numbers in the BRWM's Division of Response Services for notification of possible indications of contamination in accordance with Paragraph 1 below. DEP will investigate public water supplies where laboratory data provided by DWP indicate possible contamination by petroleum or its components or a hazardous substance. The purposes of such investigations shall be to verify the presence of man-induced contamination, and identify the source(s) of the contamination for possible remediation in accordance with BRWM's statutory and regulatory authority.

DWP agrees to:

5. Notify by FAX designated regional BRWM contact persons of laboratory analytical results, indicating newly discovered detections at concentrations above the laboratory reporting level of volatile and semivolatile chemicals or other organic chemicals, including pesticides, for which a federal Maximum Contaminant Level (MCL) or State of Maine MCL or Maximum Exposure Guideline (MEG) has been established for drinking water. BRWM contacts will also be notified of confirmed detections of inorganics for which there is a primary drinking water standard whenever such detections exceed ½ an existing MCL or MEG for the first time. BRWM will not be notified of contamination if limited to disinfection by-products, copper, lead, nitrates, nitrites, microoranisms or radionuclides. FAXed notifications shall be labeled "Report of Possible Spill."

6. Consider prior notification by BRWM followed by submittal of schematic diagrams sufficient to satisfy the requirement of Chapter 231 (3)(C) for plan submission, review and approval by DWP of POE treatment equipment.

7. Consider BRWM-installed POE treatment equipment selected, installed, and maintained as described under paragraph 2 above to meet BAT, per 40 CFR 141.61.

8. When a public water supply must be treated with aeration to remove volatile contaminants, increase to monthly the frequency of testing the finished water for microbial contamination. After six months of testing, DWP will re-evaluate with BRWM the testing frequency.

9. Notify BRWM when BRWM-installed POE equipment on a public drinking water source fails to achieve primary drinking water standards.

10. Advise BRWM of any proposed changes in DWP rules, policy, or practice which would affect BRWM in its responsibility to eliminate hazardous substances and petroleum constituents from public drinking water supplies.

11. To continue its efforts to make public water supply monitoring data more readily available to BRWM and the State's Oracle-based Groundwater Data Base, and to notify BRWM when this data is available on Oracle software.

Other Terms Of This Agreement

12. By June 1, 1999, BRWM and DWP agree to designate contact persons to receive information, inquiries, and assistance requests related to this MOA.

13. BRWM and DEP will determine the need for disinfection on aeration POE treatment systems based on the findings of the bacterial analyses conducted in accordance with this Memorandum of Understanding .

14. This Memorandum of Understanding expires on June 30, 2001.

Department of Environmental Protection	**Department of Human Services**
Bureau of Remediation & Waste Management	Bureau of Health
Signed _____	Signed _____
David Lennett, Director Bureau of Remediation & Waste Management	Dora A. Mills, Director Bureau of Health
Date: _____	**Date: _____**